MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2019

BDS4614 – MANAGEMENT DECISION SCIENCE
(All sections / Groups)

1st MARCH 2019
9.00 a.m. – 12 noon.
(3 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 6 pages excluding the cover page.

2. Answer ALL questions. The distribution of the marks are given for all questions.

3. Write all your answers in the Answer Booklet provided.

4. The statistical table is attached at the end of this question paper.

QUESTION 1

A contractor is planning a new housing development consisting of colonial, split-level and ranch style houses. A colonial house requires ½ acre of land, $60,000 capital and 4,000 labor-hours to construct and returns a profit of $20,000. A split house requires ½ acre of land, $60,000 capital and 3,000 labor-hours to construct and returns a profit of $18,000. A ranch style house requires 1 acre of land, $80,000 capital and 4,000 labor hours to construct and returns a profit of $24,000. The contractor has 30 acres of land,$3,200,000 capital and 180,000 labor-hours available

(a)   Formulate the given problem as a Linear Programming Problem.

[3 marks]

(b)   Set up the initial simplex tableau by including the necessary slack variables.

[2 marks]

(c)   Determine the second simplex tableau by using the simplex method.

[4 marks]

Given the following final tableau

C_j		20000	18000	24000	0	0	0	
	Solution Mix	X_1	X_2	X_3	S_1	S_2	S_3	Quantity
24000	X_3	0	0	1	3	0	0	10
18000	X_2	0	1	0	-4	0.0001	-0.001	20
20000	X_1	1	0	0	0	-0.0001	0.001	20
	Z_j	20000	18000	24000	0	0.2	2	1,000,000
	$C_j - Z_j$	0	0	0	0	-0.2	-2	

S_1 – slack for total land available
S_2 – slack for total budget available
S_3 – slack for total labor-hours available

(d)   How many houses of each type should the contractor construct in order to maximize profit and what is the maximum profit?   [2 marks]

(e)   Determine the dual price of total budget available and discuss the effect of increasing the budget on total profit.   [2 marks]

(f)   Determine the range of optimality for the profit contribution rate of colonial house.

[4 marks]

(g)   Determine the range for the right hand side of the labor-hours constraint without changing the dual price.

[3 marks]

[Total: 20 Marks]

Continued...

QUESTION 2

(a)   The Management of Excelsior Furniture company decided to expand its production capacity at its Batu Pahat factory and to cut back production at its other factories at Senawang and Kluang. It also recognizes a shifting market for its desks and revises the requirements at its three warehouses at Alor Setar, Seremban, and Melaka. The cost of transportation (in Ringgit Malaysia) between the factories and the warehouses, and the supply and demand data (in units) are given below:

	Alor Setar (RM)	Seremban (RM)	Melaka (RM)	Supply (units)
Batu Pahat	5	4	3	300
Senawang	8	4	3	150
Kluang	9	7	5	250
Demand (units)	200	200	300	700

(i)   Use the northwest corner rule to establish an initial feasible shipping schedule and calculate its cost.   **[5 marks]**

(ii)   Use the stepping-stone method to test whether an improved solution is possible.
                                                                              [5 marks]

Continued...

(b)   The hospital administrator at Serdang Hospital must appoint head nurses to four newly established departments: Urology, Cardiology, Orthopedics, and Obstetrics. In anticipation of staffing problem, she had hired four nurses - Chong, Cathy, Siti, and Divya. Believing in the quantitative analysis approach to problem solving, the administrator has interviewed each nurse, considered her background, personality, and talents, and developed a cost scale ranging from 0 to 100 to be used in the assignment. A 0 for nurse Cathy, being assigned to the Cardiology unit implies that she would be perfectly suited to that task. A value close to 100, on the other hand, would imply that she is not at all suited to head that unit. The accompanying table gives the complete set of cost figures (in Ringgit Malaysia) that the hospital administrator felt represented all possible assignments. Which nurse should be assigned to which unit?

Nurse	Urology	Cardiology	Orthopedics	Obstetrics
Chong	28	18	15	75
Cathy	32	48	23	38
Siti	51	36	24	36
Divya	25	38	55	12

[10 marks]

[Total: 20 marks]

QUESTION 3

The Sandakan Timber company processes 10,000 logs annually, operating 250 days per year. The company has estimated that the ordering cost is RM1,600 per order, the cost of carrying logs in inventory before they are processed is RM15 per log on an annual basis and it takes 4 days to receive the order from the supplier. Determine the following.

(a)   The economic order quantity   [5 marks]
(b)   The minimum total annual inventory cost.   [5 marks]
(c)   The optimal number of orders per year   [2 marks]
(d)   The average inventory level   -   [2 marks]
(e)   The optimal time between orders   [3 marks]
(f)   The amount of logs that should be on hand when an order is placed   [3marks]

[Total: 20 Marks]

Continued...

QUESTION 4

Sunmatec Corporation has undertaken a project that involves twelve main activities. For easy reference, the activities are named A to L. The management team has identified the immediate predecessor activity/activities and the most likely time of completion for each activity. Besides the most likely time, the optimistic and pessimistic times for completion are also obtained for each activity. The information summary is given in the table below:

Activity	Immediate Activity	Time (weeks)		
		Optimistic	Most Likely	Pessimistic
A	-	13	18	20
B	-	8	9	10
C	A	4	6	7
D	B	10	14	18
E	C	10	13	14
F	E	6	8	9
G	C	12	14	16
H	D, F, G	6	8	10
I	E	9	10	11
J	H	4	5	7
K	I, J	4	6	8
L	K	3	8	13

You are required to:

(a) Draw a network diagram to represent the project.   [5 marks]
(b) Compute the expected time and the variance for each activity time.   [4 marks]
(c) Determine the critical path.   [4 marks]
(d) Obtain the expected completion time for the project.   [2 marks]
(e) Calculate the variance in the expected completion time for the project.   [2 marks]
(f) What is the probability that the project can be completed within 68 weeks?

[3 marks]

[Total: 20 marks]

Continued...

QUESTION 5

(a)   A restaurateur is going to set up a cream tea stall at a local gala. On the morning of the gala she visits the wholesale market and has to decide whether to buy a large, medium or small quantity of strawberries, scones, cream and other materials. Her profit depends on the number of people attending the gala, and this in turn depends on the weather. The pay-off for different weather conditions is given below:

Alternative-buy	Weather Conditions		
	Good	Average	Poor
Large quantity	$10000	$4000	-$2000
Medium quantity	7000	6000	2000
Small quantity	4000	1000	4000
Probability	0.3	0.5	0.2

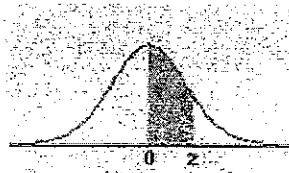Determine the best decision, using the following decision criteria:

(i)   Maximax   [2 marks]
(ii)   Maximin   [2 marks]
(iii)   Hurwicz criterion of realism ($\alpha = 0.7$)   [3 marks]
(iv)   Equally Likely   [2 marks]
(v)   Minimax regret   [3 marks]
(vi)   Expected Monetary Value   [3 marks]

(b)   In a study of scientific research on soft drinks, juices and milk, 65% were fully sponsored by the food industry, and 35% studies were conducted with no corporated ties. Of those that were fully sponsored by the food industry, 14% of the participants found the products unfavourable, 23% were neutral, and 63% found the products favorable. Of those that had no industry funding, 38% found the products unfavourable, 15% were neutral and 47% found the products favorable. If a participant selected at random found the product favorable, what is the probability that he or she belongs to a group that participated in a corporate-sponsored study?

[5 marks]

[Total: 20 marks]

End of Question Page.

Appendix

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974